28 July 1967

NARRATIVE SUMMARY

1. Project Title: Automatic Focusing System

STAT 2. Contractor: [redacted]

Declass Review by NIMA/DOD

3. Project Number: NP-V-21-02218

STAT Monitor: [redacted]

4. Brief Description: There is a basic need for a precise, simple, and relatively inexpensive automatic focusing device which can be applied to various high performance optical equipment with a commensurate improvement in the efficiency of the photo interpretation operation. One of the most promising applications is for use in rear projection viewing equipment. [redacted] STAT has developed a promising technique which utilizes the signal output of a vibrating non-linear photo cell to drive a servo system to automatically maintain the current focus. The current effort is directed toward the development of a working model of an automatic focusing rear-screen projector. The basic techniques were developed in the course of a preceeding project with [redacted] STAT and are reported in detail in the final report, "Automatic Focusing Techniques."

5. New Capability Provided: Automatic focusing will be an integral part of other NPIC programs under development; i.e., automatic stereo scanning and rear projection viewing equipment. Although automatic focusing systems are in existence they are too costly and complex, lack precision, require periodic calibration, and cannot be applied to a variety of lens systems.

6. Equipment/Techniques to be Replaced: The successful application of automatic focusing to equipment requiring the operator to constantly focus and refocus would eliminate operator fatigue and improve his efficiency.

7. Status:

a. This development is currently in the Engineering Development Category.

b. FY66-FY67 funds took this project through the Completed Study Phase.

c. FY68 funds are proposed for incorporating the results into a Prototype rear projection viewer.

STAT 8. Remarks: The results of the current effort will be made available to all contractors responsible for equipment design and construction requiring an automatic focusing capability. [redacted] STAT is planned for completion in FY68.

9. Related CIA/DoD Efforts: There is no known equipment available or under development which will satisfy this requirement.

10. Coordination Accomplished and Anticipated: This project has been coordinated with DD/S&T/ORD and presented to representatives of the Army, Navy, and Air Force. Continual liaison with the aforementioned organizations will be maintained.

FILE # 02218

AUTOMATIC FOCUSING REAR-SCREEN PROJECTOR

Project Report for the Period 15 September to 15 November 1967

This report covers a two month period. There were delays in receiving and assemblying critical components for the lens servo system which delayed the progress during the first month of this reporting period. The lens servo is now complete and system tests are ready to begin.

The first tests to be run will use a twelve inch focal length lens providing a three times image magnification. Tests of the static focusing error will be followed by tests to determine the dynamic error as a function of the frequency and amplitude of the film displacement.

Preliminary tests with the film drive operating, the projector light source operating, and a viewing screen will then be made for a subjective evaluation of performance for comparison with the preceeding quantative test measurements. Following satisfactory completion of these tests a shorter focal length lens will be used to determine the static performance of the system at higher magnifications.

There are adequate project funds to complete the desired tests on the prototype projector, however, the delays in assemblying the lens servo leave only two months remaining for the completion of the tests and the writing and printing of the final report. It is therefore desirable that a formal request be made through our contract officer for a one month's project extension to allow for editing and publishing of the final report. No increase in project funds will be required.

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20 November 1967

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 FILE #02218

AUTOMATIC FOCUSING REAR-SCREEN PROJECTOR

Project Report for the Period 15 August to 15 September 1967

During this period the detailed design of the lens servo system was completed, all required components were ordered, and the construction and assembly of the mechanical components were nearly completed.

Project personnel took vacation during this period.

As mentioned in the last report, this month and the next month will be spent in completing the lens servo and testing its operation. The work is proceeding on schedule with the exception of a two-week delay in delivery of a precision lead screw. It is still anticipated that the overall system will be completed by 15 October and be ready for testing and evaluation.

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 # 02212

AUTOMATIC FOCUSING REAR-SCREEN PROJECTOR

Project Report for the period July 15 to August 15, 1967

The film drive unit has been completed and tested. Preliminary measurements of the dynamic variation of the film plane were made using the focus detection optics. Analysis of the data indicates that at a film speed of 2 inches per second, the film plane variation (at the center of a nine-inch square frame) is confined to a peak-to-peak range of approximately 0.1 inch. The frequency range of the film plane variations extends up to 10 cycles per second with amplitudes less than .040 inches. Further experiments will be made at different film speeds and at different film tension values to determine the relative effects on the magnitudes and frequencies of the film variations.

The design of the servo system to control the lens position to maintain focus will begin immediately using the above data as a guide for the performance requirements of the servo system.

The electronic and mechanical components for the lens servo subsystem are a major part of the demonstration focusing unit. The design, construction, and initial testing of this subsystem will be the major project effort during the next two months.

On completion of the lens servo subsystem, the overall focusing projector can begin to be tested and evaluated.

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AUTOMATIC FOCUSING REAR-SCREEN PROJECTOR

Project Report for the period June 15 to July 15, 1967

During this period the following tasks were accomplished.

(1) A film drive mechanism was designed, constructed, and is ready for testing.

STAT (2) A [ ] (V-184) enlarger was delivered and modified to serve as the basic frame for the demonstration projector and to provide the projection light source.

(3) A preliminary model of the focus detection optics has been constructed and will be used to measure the dynamics of the film plane variation as it is driven through the film drive.

The effort for the next month will concentrate on the following two main tasks.

(1) Determine the film plane movement characteristics at scanning speeds.

(2) Design, order components, and begin construction of the lens positioning servo that is required to control focus.

The possibility of using air to control the film position is still under consideration. If it is not a suitable means of focus control it will be considered for use as a means of obtaining a controlled film displacement for use in testing the focus detection and lens servo system.

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AUTOMATIC FOCUSING REAR-SCREEN PROJECTOR

Project Report for the period May 15 to June 15.

Project effort during this period has been concentrated in two areas:

(1) Selecting the major components required for the construction of the demonstration projector and placing purchase orders.

(2) Beginning detailed design of the film drive unit and the focus-detection optics.

The focus-detection optics will be first used as a measurement tool to monitor the film displacement during motion at typical film scanning speeds. This information is necessary for the final design of the film drive, the focus-detection optics, and, in particular, for the selection and specification of the focus-correction technique to be employed.

Two control techniques are under consideration to maintain critical focus on the viewing screen in response to the error signal from the focus-detection optics.

(1) Controlling the projector lens position, and

(2) Maintaining that film plane position by controlling air pressure in the air space between the film and the condenser lens.

Further study of these two techniques, combined with the experimental measurement of the actual film dynamics, will lead to selection of one of these techniques for use in the demonstration unit.

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